

REMARKS

Claims 16 and 17 have been canceled. Claims 10, 11, 14, and 15 have been previously canceled. Claims 1, 2, 5, 13, and 20 have been amended. Claims 1 through 9, 12, 13, and 18 through 20 remain in the application.

Claims 1 through 8 and 20 were rejected under 35 U.S.C. § 103 as being unpatentable over Hutchings (U.S. Patent No. 2,206,356) in view of Hoover (U.S. Patent No. 4,964,391) and further in view of Wynn (U.S. Patent No. 4,129,145). Applicants respectfully traverse this rejection.

U.S. Patent No. 2,206,356 to Hutchings discloses a check valve. A valve casing 6 is provided at each end with screw threads to receive an outer member 7 of the unions whose inner members 8 are screwed to the end of pipes 9. A movable valve is constructed of a tubular portion 11 which is made to freely slide in a hole 12 provided in a valve cage 12 which has on one end an outwardly extending flange 14 tightly clamped between the inner member 8 of the union and the end of the valve casing 6. The other end of the valve cage 13 is provided with a valve seat 15 arranged to be engaged by a valve cap 16 rigidly secured to the one end of the tubular portion 11 being provided with a shoulder 17 to serve as a stop against the one end of the valve cage 13. A plurality of holes 19 are shown through the tubular portion 11 a considerable distance from the valve cap 16 and fibre washer 20 which form a free passage for the fluid within the tubular portion 11 to enter the interior of the valve casing 6 when the valve is in a considerable open position. Hutchings does not disclose a valve seat formed on an interior surface of a valve housing with a generally frustaconical cross-sectional shape and a valve member having said valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the

valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position.

U.S. Patent No. 4,964,391 to Hoover discloses a check valve for engine fuel delivery systems. A fuel delivery system 20 includes a fuel pump 22 for delivering fuel under pressure from a supply or tank 24 to a fuel consumer 26, such as an internal combustion engine. A check valve 28 is connected in a fuel line between the fuel pump 22 and the engine for permitting free flow of fuel from the pump to the engine, but preventing back-flow of fuel from the engine to the pump when the pump is shut off. Hoover does not disclose a valve seat formed on an interior surface of a valve housing with a generally frustaconical cross-sectional shape and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position.

U.S. Patent No. 4,129,145 to Wynn discloses a check valve assembly. valve seat 14 is located on the interior surface of valve body 10. A valve seat 14 has a seating surface 16 facing toward a downstream end 12 of a valve body 10. The seating surface 16 is preferably inclined with respect to a centerline of the valve body 10. A shoulder 18 is located on the upstream side of the valve seat 14 and defines a recess 20. A poppet element 22 is adapted to be inserted within the valve body 10 through an upstream end 11 thereof. The poppet element 22 has a circumferential surface 24 at its downstream end. The circumferential surface 24 has a narrow neck 26, and the portion 28 of the circumferential surface 24 downstream of the neck 26

has a frustoconical configuration. Wynn does not disclose a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position.

In contradistinction, claim 1, as amended, clarifies the invention claimed as a check valve for a fuel pump including a valve housing adapted to be disposed in an outlet member of the fuel pump and a valve seat formed on an interior surface of the valve housing. The valve seat has a generally frustoconical cross-sectional shape. The check valve also includes a valve member disposed in the valve housing and having a closed position to engage the valve seat to prevent fuel from flowing through the outlet member and an open position to allow fuel to flow through the outlet member. The valve member has a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub and a seal disposed in the groove for contacting the valve seat when the valve member is in the closed position. The valve member has at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in the closed position and allowing fluid flow past the valve seat when the valve member is in the open position.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore

Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that “[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.” In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) (“In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.”)

None of the references cited, either alone or in combination, teaches or suggests the claimed invention of claim 1. Specifically, Hutchings ‘356 merely discloses a check valve having a plurality of holes through a tubular portion a considerable distance from a valve cap and fibre washer which form a free passage for the fluid within the tubular portion to enter the interior of a valve casing when the valve is in a considerable open position. Hutchings ‘356 lacks a valve seat formed on an interior surface of a valve housing with a generally frustaconical cross-sectional shape and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Hoover ‘391 merely discloses a check valve for engine fuel delivery systems in which a check valve is connected in a fuel line between a fuel pump and an engine. Hoover ‘391 lacks a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for

contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Wynn '145 merely discloses a check valve assembly having a valve seat located on an interior surface of a valve body. Wynn '145 lacks a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. There is no suggestion or motivation in the art for combining Hutchings '356, Hoover '391, and Wynn '145 together.

The references, if combinable, fail to teach or suggest the combination of a check valve for a fuel pump including a valve seat formed on an interior surface of a valve housing with a generally frustaconical cross-sectional shape and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position as claimed by Applicants. The claimed combination is novel and unobvious because the check valve has a pintel that must travel a given dwell distance away from the valve seat before an outlet port is exposed, allowing an increase in flow area to prevent low flow restriction. The Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claim 1 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

As to claim 20, claim 20, as amended, clarifies the invention claimed as a fuel pump including an outlet member having a first passageway therethrough and a valve housing disposed in the first passageway of the outlet member. The valve housing has a body portion with a second passageway extending axially therethrough. The fuel pump also includes a flow tube extending axially from one end of the body portion and a valve seat disposed adjacent the second passageway and formed on the valve housing adjacent the flow tube. The valve seat has a generally frustaconical cross-sectional shape. The fuel pump includes a valve member disposed in the second passageway of the valve housing and having a closed position to engage the valve seat to prevent fuel from flowing through the outlet member and an open position to allow fuel to flow through the outlet member. The valve member has a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position. The valve housing has an enlarged opening at one end of the second passageway and the valve member has a flange at one end and disposed in the enlarged diameter portion. The fuel pump includes a spring disposed about the valve member between the flange and surface of the enlarged diameter portion to urge the seal and valve member toward the valve seat. The valve member has a flow port extending therein with at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in the closed position and allowing fluid flow past the valve seat when the valve member is in the open position.

None of the references cited, either alone or in combination, teaches or suggests the claimed invention of claim 20. Specifically, Hutchings '356 merely discloses a check valve having a plurality of holes through a tubular portion a considerable distance from a valve cap and

fibre washer which form a free passage for the fluid within the tubular portion to enter the interior of a valve casing when the valve is in a considerable open position. Hutchings '356 lacks a fuel pump including an outlet member having a first passageway therethrough, a valve housing disposed in the first passageway of the outlet member, a flow tube extending axially from one end of the body portion, a valve seat disposed adjacent the second passageway and formed on the valve housing adjacent the flow tube with a generally frustaconical cross-sectional shape, and a valve member having a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Hoover '391 merely discloses a check valve for engine fuel delivery systems in which a check valve is connected in a fuel line between a fuel pump and an engine. Hoover '391 lacks a fuel pump including an outlet member having a first passageway therethrough, a valve housing disposed in the first passageway of the outlet member, a flow tube extending axially from one end of the body portion, a valve seat disposed adjacent the second passageway and formed on the valve housing adjacent the flow tube with a generally frustaconical cross-sectional shape and a valve member having a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Wynn '145 merely discloses a check valve assembly having a valve seat located on an interior surface of a valve body. Wynn '145 lacks a fuel pump including an outlet member having a first

passageway therethrough, a valve housing disposed in the first passageway of the outlet member, a flow tube extending axially from one end of the body portion, a valve seat disposed adjacent the second passageway and formed on the valve housing adjacent the flow tube with a generally frustaconical cross-sectional shape and a valve member having a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. There is no suggestion or motivation in the art for combining Hutchings '356, Hoover '391, and Wynn '145 together.

The references, if combinable, fails to teach or suggest the combination of a fuel pump including an outlet member having a first passageway therethrough, a valve housing disposed in the first passageway of the outlet member, a flow tube extending axially from one end of the body portion, a valve seat disposed adjacent the second passageway and formed on the valve housing adjacent the flow tube with a generally frustaconical cross-sectional shape, and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position as claimed by Applicants. The Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claim 20 is allowable over the rejection under 35 U.S.C. § 103.

Claims 9, 13, and 16 through 19 were rejected under 35 U.S.C. § 103 as being unpatentable over Hutchings (U.S. Patent No. 2,206,356) in view of Hoover (U.S. Patent No. 4,964,391) and in view of Wynn (U.S. Patent No. 4,129,145) and further in view of Clifton (U.S. Patent No. 2,011,333). Applicants respectfully traverse this rejection.

U.S. Patent No. 2,011,333 to Clifton discloses a valve. An edge 10 at a lower end of a valve member and within which a chamber 9 is formed is provided with serrations 11. Clifton does not disclose a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position.

As to claim 13, claim 13, as amended, clarifies the invention claimed as a check valve for a fuel pump including a valve housing adapted to be disposed in an outlet member of the fuel pump. The valve housing has a passageway extending axially therethrough. The check valve also includes a valve seat formed on an interior surface of the valve housing forming the passageway. The valve seat has a generally frustaconical cross-sectional shape. The check valve includes a flow tube extending axially from one end of the valve housing adjacent the valve seat. The check valve further includes a valve member disposed in the passageway of the valve housing and having a closed position to engage the valve seat to prevent fuel from flowing through the outlet member and an open position to allow fuel to flow through the outlet member. The valve member has a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and a flow port extending therein with at least one outlet port having a metered shape a predetermined

dwell distance from the valve seat when the valve member is in the closed position and allowing fluid flow past the valve seat when the valve member is in the open position.

None of the references cited, either alone or in combination, teaches or suggests the claimed invention of claim 13. Specifically, Hutchings '356 merely discloses a check valve having a plurality of holes through a tubular portion a considerable distance from a valve cap and fibre washer which form a free passage for the fluid within the tubular portion to enter the interior of a valve casing when the valve is in a considerable open position. Hutchings '356 lacks a valve seat formed on an interior surface of a valve housing forming a passageway with a generally frustaconical cross-sectional shape, a flow tube extending axially from one end of the valve housing adjacent the valve seat, and a valve member having a hub with a generally hemispherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Hoover '391 merely discloses a check valve for engine fuel delivery systems in which a check valve is connected in a fuel line between a fuel pump and an engine. Hoover '391 lacks a valve seat formed on an interior surface of a valve housing forming a passageway with a generally frustaconical cross-sectional shape, a flow tube extending axially from one end of the valve housing adjacent the valve seat, and a valve member having a hub with a generally hemispherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position.

Wynn '145 merely discloses a check valve assembly having a valve seat located on an interior surface of a valve body. Wynn '145 lacks a valve seat formed on an interior surface of a valve housing forming a passageway with a generally frustaconical cross-sectional shape, a flow tube extending axially from one end of the valve housing adjacent the valve seat, and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. Clifton '333 merely discloses a valve having a valve member with chamber provided with serrations. Clifton '333 lacks a valve seat formed on an interior surface of a valve housing forming a passageway with a generally frustaconical cross-sectional shape, a flow tube extending axially from one end of the valve housing adjacent the valve seat, and a valve member having a hub with a generally hemi-spherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position. There is no suggestion or motivation in the art for combining Hutchings '356, Hoover '391, Wynn '145, and Clifton '333 together.

The present invention sets forth a unique and non-obvious combination of a check valve having reduced noise generation due to elimination of pintel oscillations. The references, if combinable, fail to teach or suggest the combination of a check valve for a fuel pump including a valve seat formed on an interior surface of a valve housing forming a passageway with a

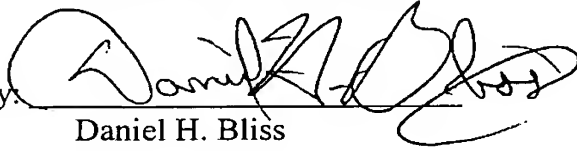
generally frustaconical cross-sectional shape, a flow tube extending axially from one end of the valve housing adjacent the valve seat, and a valve member having a hub with a generally hemispherical shape and an annular groove extending radially into the hub, a seal disposed in the groove for contacting the valve seat, and at least one outlet port having a metered shape a predetermined dwell distance from the valve seat when the valve member is in a closed position and allowing fluid flow past the valve seat when the valve member is in an open position as claimed by Applicants.

Further, the CAFC has held that “[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification”. In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants’ invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claim 13 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejections of claims 1 through 20 are improper. Therefore, it is respectfully submitted that claims 1 through 20 are allowable over the rejections under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance or in better form for appeal. Applicants respectfully request reconsideration of the claims and withdrawal of the final rejection. It is respectfully requested that this Amendment be entered under 37 C.F.R. 1.116.

Respectfully submitted,

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Date: March 22, 2001

Attorney Docket No.: DP-305705